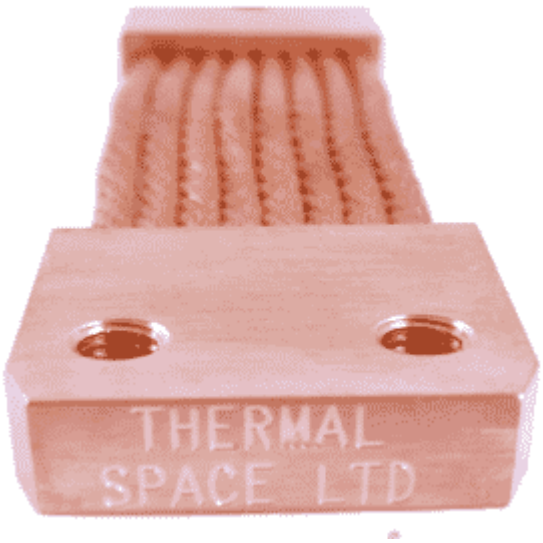
Cabled Copper Thermal Straps



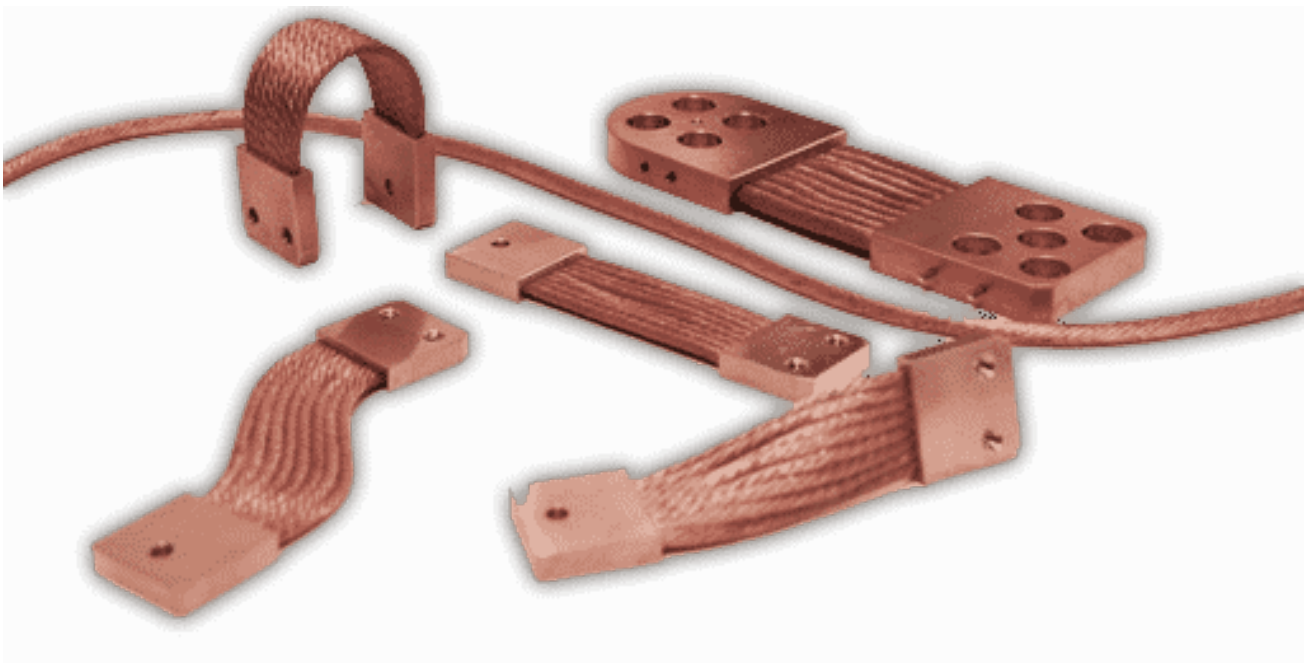
Our simplest and most cost effective thermal straps are built from bundled or cabled copper wire strands that are then captured into solid copper end fittings. Our fabrication process is established and proven over time and uses no solders, adhesives, or other means of attachment…..just **100 percent pure copper**.

We do not use “braids” in our straps because such configurations are non-symmetrical and do not provide uniform flexibility. Similarly, we do not use “rope” that consists of twisted or braided strands designed to maximize tensile strength. In a thermal strap, it is the combination of thermal conductance and mechanical flexibility that are important and our straps are designed and use materials to maximize both.

The 4C-PURE™ Advantage

4C-PURE™ and 4C-PURE-CRYO™ Straps are Thermal Space Ltd.’s product line of pure copper thermal straps fabricated from 100% oxygen-free copper (no fillers, binders, solders, adhesives, coatings, or other materials).

The -CRYO series straps are intended for low-temperature service and include material certifications for copper purity and the option for cryogenic testing to verify superior performance in cold applications. By fabricating thermal straps from only high-purity copper we provide the maximum performance metal strap product available in the market today.

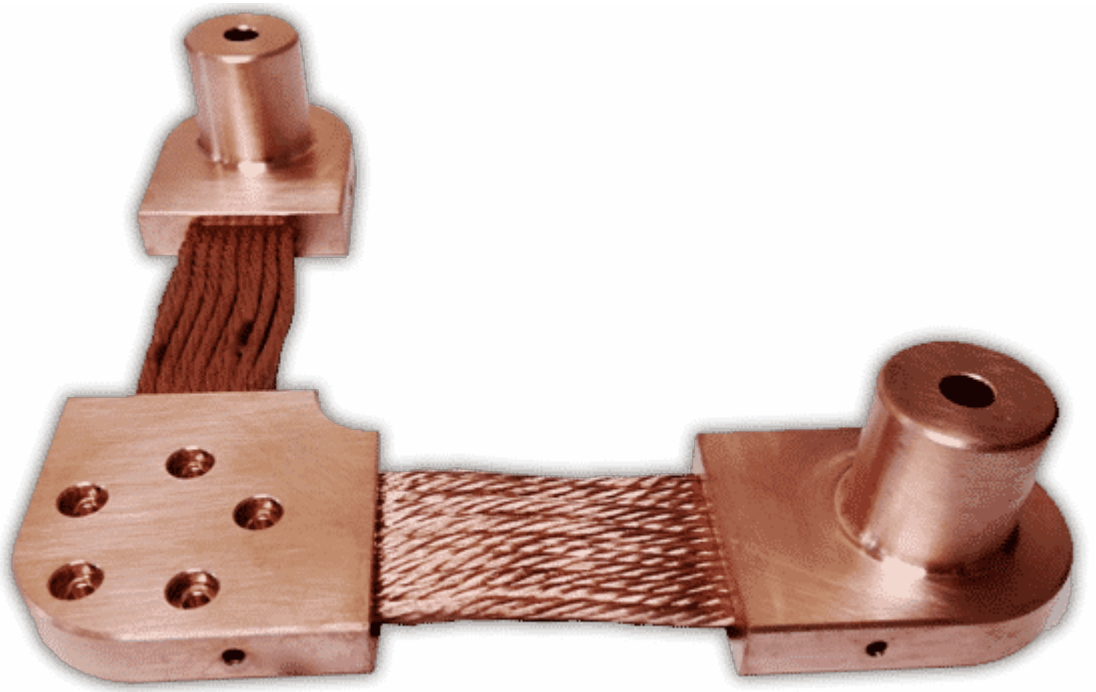


Often Copied… But Never Reproduced

Our Conductive Compliant Cabled Copper (4C) – PURE thermal straps are fabricated to exacting standards using common and well-established fabrication techniques that assure high quality, superior performance, and repeatability when multiple units are required. While we understand that nearly anyone can produce a thermal strap, the cost and performance advantages that we bring to our customers are the direct result of more than a quarter century of experience in developing thermal straps as well as other thermal component and systems hardware for the aerospace and defense industries. Specifically, the cost and performance advantages in our copper thermal straps are achieved through:

- **rapid concept development** – once we have your requirements we will typically have a concept to you within a day. Need help capturing your requirements? That's not a problem; we have helped many customers with this.
- **accurate modeling and analysis to predict performance** – our empirical models developed through many years of thermal engineering experience will assure that your strap will conform to your minimum requirements.
- **concept to fabrication drawings** – we move from concept to production phases at an unequaled pace and we involve you in the process. All assembly drawings are customer approved prior to any fabrication.
- **fabrication repeatability** – because our concept, fabrication, and verification processes are consistent and well defined, our thermal straps perform with a high-degree of predictably and repeatability.
- **post-fabrication cleaning** – we deliver straps that are ready for integration out of the package; our cleaning procedures are based upon understanding the manufacturing process and surface chemistry for the most effective removal of potential contaminants.
- **mechanical and thermal performance verification testing**– whatever qualifications are required to prove the performance of your thermal straps we are equipped and experienced to meet those needs, including cryogenic testing.

Unlike some companies that are around to just vend thermal straps, you can rest assured that with Thermal Space Ltd., real engineering principles, knowledge, and experience are behind each design and reflected in the optimum performance of each unit.

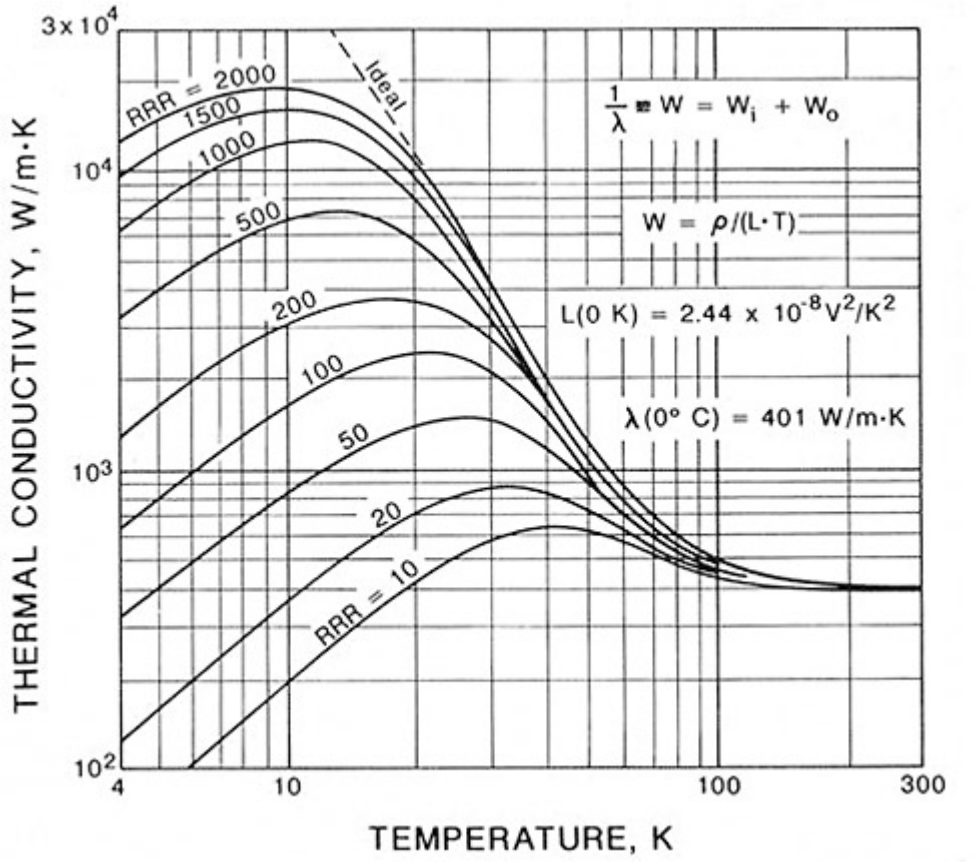


OFHC Copper(C10100) Material Selection

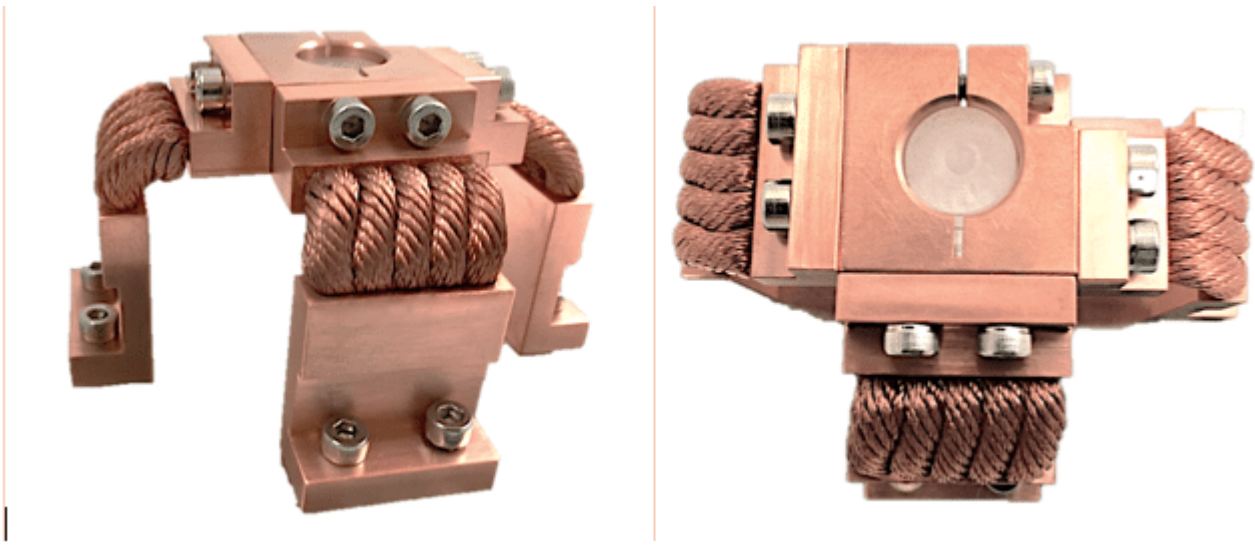
Our 4C-PURE™ Thermal Straps use entirely oxygen-free high-conductivity (OFHC) copper in the construction. OFHC copper provides superior low-temperature thermal performance compared to other commercially available purities and is typically not a cost driver, even if low-temperature service is not required. The figure below shows the temperature dependent thermal conductivity of copper as a function of temperature and different purity levels as defined by the residual resistivity ratio (RRR).

You can read more about RRR in copper here:http://www.jim.or.jp/journal/e/pdf3/38/08/714.pdf

(Graph courtesy of www.copper.org)



OFHC copper typically has a RRR between 100 and 200 and thus the large increase in thermal conductivity from warm to cold temperatures makes this high-purity copper the preferred material selection in our thermal straps.



Cryocooler Interface Thermal Strap Assembly Provides More Than 1 W/K Thermal Conductance

Flexible Cable Configuration

4C-PURE™ Thermal Straps are designed to move the most heat and provide exceptional utility in most thermal management applications. Where weight is a dominant parameter, our carbon-based Thermal LyNX®straps are the optimum choice, excelling at thermal conductance on a weight basis.